THE ELECTRICAL WORLD

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The Edwards Dynamo-Electric Machine.

The dynamo-electric machines which have assumed prominence, or have had prominence thrust upon them, may be divided into two classes, which we will call the "closed circuit" and the "open circuit." These designating terms are derived from the modes of connecting up the coils of wire, called bobbins, on their armatures. The well-known Gramme, Siemens and Weston armatures are types of the first-named class.

The Gramme armature consists of a ring of many convolutions of iron wire, which ring is covered within and without the circle by a considerable number of bobbins of insulated copper wire. These bobbins are made by reeving the insulated wire through the ring, over and around its mass across the plane of its circumference. When a definite number of convolutions have thus been made within a defined width and thickness, another like bobbin is reeved alongside the first, and so on until the iron ring is completely covered. The beginning-end of the wire of each bobbin is then joined with the ending-end of the wire of the next adjacent bobbin in one direction; and so on until the bobbins have all been connected together and an endless series of bobbins thus obtained. The junctions of the wires of the several bobbins are then connected with the segments of a cylindrical collector, called a commutator, from which the electric current generated in the bobbins is conducted to the external circuit.

The Siemens armature is composed of a like core of iron, but the bobbins are wound entirely upon the outside of the ring or cylinder, and the ends of the bobbins are connected in an electrically similar manner to those of the Gramme, to a collector called a commutator. The Weston armature has a similar winding and like connections upon a more nearly solid iron cylinder.

The well-known Brush armature and the Thomson-Houston armature are types of the "open-circuit" class. The most recent Brush armature consists of a ring made by winding a long strip of sheet-iron, layer upon layer, until the desired thickness is obtained for the iron core. In this iron core eight recesses are made at equal distances to receive a like number of bobbins which are rove therein. Diametrically opposite bobbins have their beginning-ends of wire connected together, but their other ends are carried to the two halves, one to each, of a commutator. The four pairs of bobbins have each a commutator. As the two halves of each commutator are merely enlarged terminals of each pair of bobbins, and as they are insulated from each other except through their bobbins, the circuits are open; and in running they are sucessively thrown into and out of the circuit which they serve to supply. There is a peculiarity about the commutator which we will speak of hereinafter when we come to describe the Edwards machine.

The Thomson-Houston armature consists of a core of iron spheroidal in shape, and covered with three bobbins only of insulated wire wound in a direction resembling meridian lines. Like ends—say the inner ones—of these bobbins are connected together, and the other ends are connected to the segments of a commutator consisting of three equal sectors of 120 degrees each, one end to each sector. These bobbin-circuits are thus normally open, except when closed by the brushes through an external circuit.

The Edwards armature is an open-circuit one, and its main peculiarity is in its manner of commutating the currents which are generated in the coils or bobbins of its armature during operation. Therefore it can be made in a number of ways, resembling the Gramme, Siemens, Weston and Brush armatures, except that in all cases the bobbins must be open-circuited to a commutator instead of to a collector, for the reasons herein set forth.

The Edwards dynamo-electric machine is the invention and design of Mr. Edgar A. Edwards, of Cincinnati, Ohio, and is manufactured by the Commercial Electric Co., of Dayton, Ohio. We have recently seen one of these machines in operation in Thirteenth street in this city, running twenty-one arc lamps on a circuit having about eleven ohms resistance, other than the resistance of the lamps, and we deem the result of the tests there made to be of interesting value to our readers. Therefore we proceed to describe and illustrate that machine and point out its peculiarities.

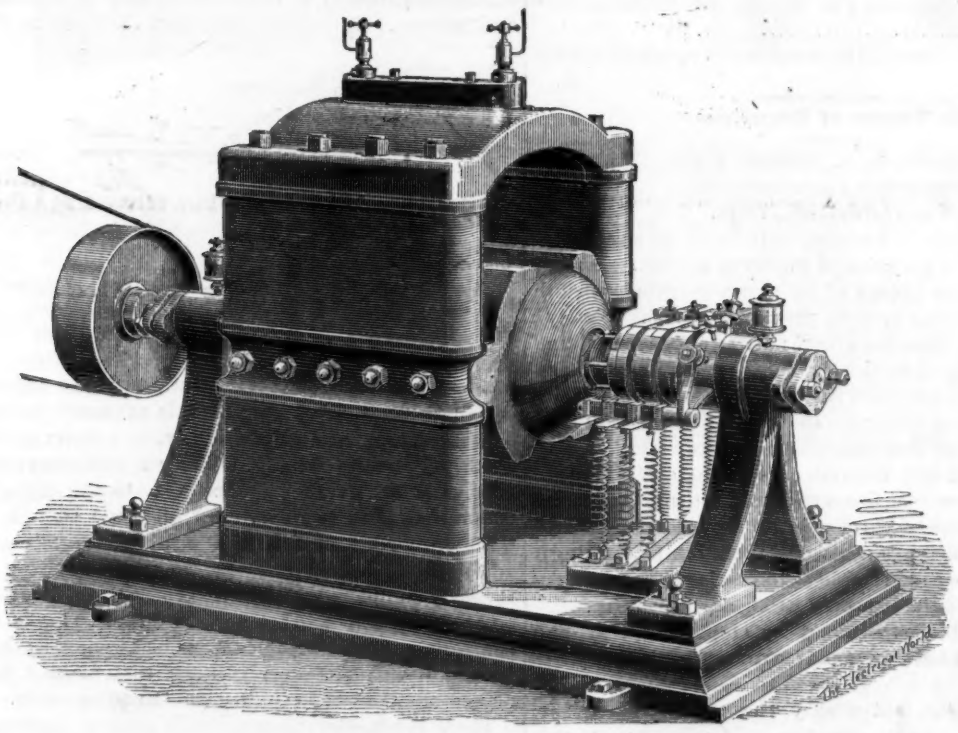

FIG. 1.—THE EDWARDS DYNAMO.

Fig. 1 is a perspective view of the machine. Upon a cast-iron base two magnet cores of cast-iron are erected and are capped as shown by the arched cast-iron piece to complete the magnetic circuit. The base is reinforced with iron underneath, between the two cores, so as to make a sufficient mass of metal. To the centres of these two vertical cores are bolted the pole pieces, facing each other, which constitute the consequent poles of the field magnets. Four bobbins of No. 8, B. & S. gauge magnet wire are wound upon these cores and are connected up in series, so that by means of currents which are caused to circulate in them one pole piece has north polarity conferred upon it and the other has south polarity.

Two standards, carrying boxes for the shaft of the armature, are likewise erected upon the base. These boxes are made to fit tapering journals on the armature shaft, so that by means of suitable caps and set screws (one of which caps is shown at the box on the foremost standard) the boxes may be moved toward each other: that is, further on to the tapering journals of the shaft, to compensate for wear of the journals and boxes. Thus far the machine does not differ in electrical particulars from others of its class except in design and workmanship.

The armature consists of a core and three bobbins, which are made of 85 lbs. of No. 12 B. & S. gauge, double covered magnet wire, and the two ends of each bobbin are carried to two halves of a commutator belonging to that bobbin: so that there are three commutators. These commutators are fastened to the shaft so that their break-lines are 120° from each other, or so that one of the two breaks in each commutator follows the preceding one in coming under the brush in each 60° of a rotation. The brushes are connected up in series with each other and with the field-magnet coils and the external circuit.

Fig. 2 represents a cross-section of the armature, and a description of the figure will convey a good idea of its construction. *X* is the shaft, and fastened to it is the wooden hub *B*. The wooden hub extends nearly the length of the armature and has six semi-cylindrical grooves *N* made in it, to act as air channels in ventilation, and to receive the bases of the sheet-iron clamps *d*. *D* represents a flat ring made by winding between the arms of the six clamps *d* a ring of No. 25 iron wire. This ring is one inch deep and three-sixteenths inch thick, and weighs .74 pound. There are 62 of these rings placed on the wooden hub, side by side, but insulated from one another. They weigh 46 pounds altogether. The clamps *d* keep them slightly apart, so that air which is drawn into the grooves during rotation escapes through the spaces between the rings, and thus serves to conduct off heat which would otherwise accumulate.

The ends of the clamps project as shown, and are pierced with holes *E*. When the lot of rings are in place these

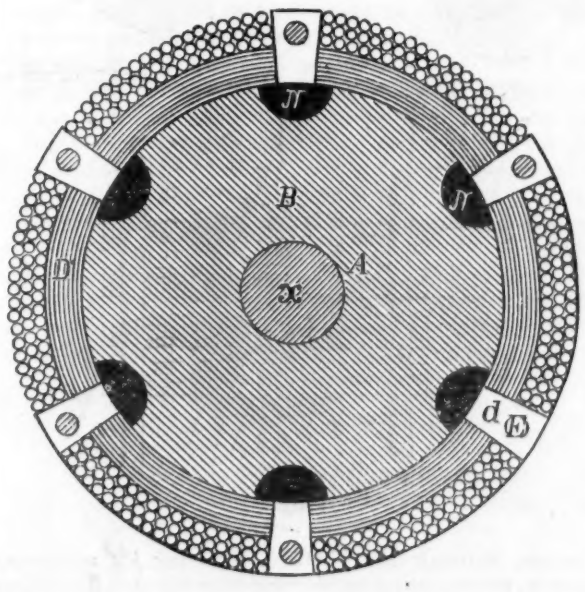

FIG. 2.

holes receive six tie rods, which pass through them and through similar holes of two solid half-round rings, one at each end of the core. These solid rings are screwed to the wood to bind the whole together in one solid mass. The six spaces between the ends of the clamps are of equal area, and receive the bobbins of insulated wire, the sections of which are shown in the figure. This construction of core so separates and insulates the iron of the ring that Ampérean currents are very much reduced and their ill-effects almost entirely obviated.

The coils of wire constituting the bobbins are wound in greater part parallel with the shaft, but cross diametrically from side to side as with the Siemens armature winding. The ends are, however, left free to be connected to the commutators. The commutators are of peculiar construction and special to this machine. They are best illustrated by the parts, separate and assembled, shown by Fig. 3. This figure shows four commutators, such as are intended for four bobbins. Those for three bobbins differ only in number. A description of one answers for the lot, as they are all alike.

Upon the shaft is placed a disc *h* of insulating material, and upon the periphery of this disc two semi-annular metal pieces *i* and *j* are suitably fastened. A small space is left between the ends so that they are electrically insulated from each other. Each piece has two rectangular portions removed from it, one from each end, but from opposite sides of the piece. A piece of metal *K* also passes over the shaft, but out of contact with it, and it

has two lugs *l l* at right angles to its plane. These lugs nearly fill the spaces formed by the removed parts of the commutator pieces, but they are insulated from the pieces.

Now, when the brushes bear upon the commutator at the breaks between the pieces, they also bear upon the piece of metal *K*. This is also the case for some distance in the rotation of the commutator before the breaks reach the brushes and after passing them. During this time of bearing of the brushes on the piece *K*, and in this way, the bobbin connected with the two pieces *i* and *j* is short-circuited upon itself. This time or space of short-circuit is that in which the bobbin is passing the line of magnetic neutrality midway between the poles. In this feature resides the special excellence of the Edwards system of commutating the currents generated in the armature.

In the machine we are describing three such commutators are fastened on the shaft, at suitable distances apart, and with their breaks sixty degrees apart circumferentially. The electrical connections between the ends of the wires of the bobbins and their respective commutator divisions or pieces, are made by means of conducting-rods which pass to the insulating discs of the three commutators, and through the ones between each and the armature. Suitable connections of the bobbin wires and of the commutator pieces are made to the conducting rods.

There are as many pairs of brushes as there are commutators. The positive brushes are held by one brush holder, and the same is the case with the negative brushes. But each brush is separately insulated from its holder. The brushes are electrically connected together so that the current generated in one bobbin passes to its positive brush, and from there to the negative brush of the next

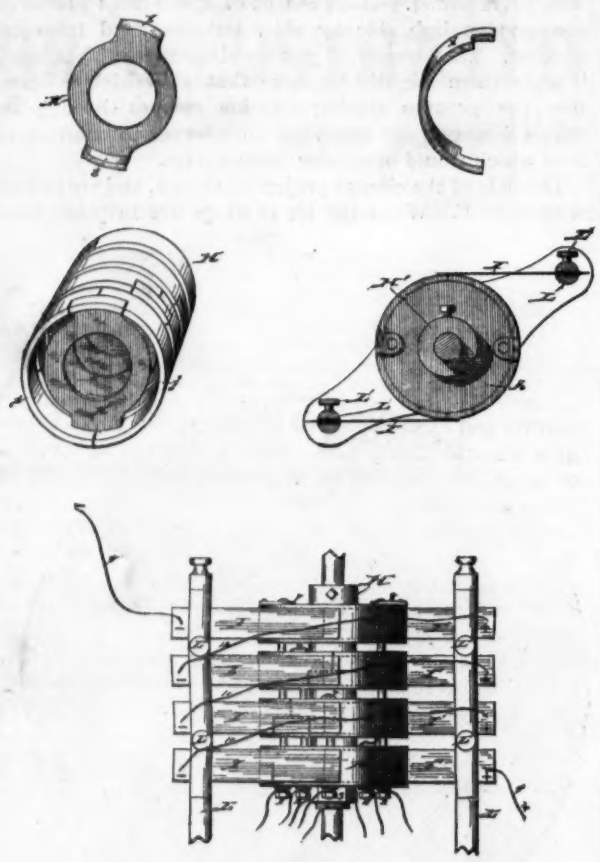

FIG. 3.

bobbin, through that bobbin, receiving its additional energy, to its positive brush; and so on through the several bobbins to the external circuit, and the field magnets, as in other series machines, with this exception:—As the edge of a bobbin reaches the neutral line, so does its short-circuiting piece *K* reach and pass under the appropriate pair of brushes, thus short-circuiting that bobbin by a conductor of comparatively no resistance. This condition is diagrammatically represented by Fig. 4, in which $e\,e'\,e''$ represent the three bobbins, and *I I* the connection of the commutator with the brushes, and *K* the short circuit. It is plain, then, that nearly all of the current from the two other bobbins will flow through *K* instead of through *e'*, where it would receive no addition to strength or electromotive force.

This described action is repeated with each successive bobbin as it passes through the neutral zone. The bobbins are never passed out of circuit, as in other machines, but are merely bridged at proper intervals, to allow of the passage of currents which would otherwise receive no assistance there, but would lose the proportion of their energy due to the resistance they would encounter. Thus much of the sparking between commutator and brushes, which is so observable and objectionable in other open-circuit machines, is avoided with a corresponding increase in efficiency, and decrease in cost and frequency of repairs.

The machine runs quietly, and during the half hour in which we observed its operation the possible rise in temperature of the armature was not appreciable, though twenty-three lamps were in its circuit. We do not think that such an arrangement of bobbins, etc., gives a continuous current of constant strength, but rather one which is pulsating—rising and falling in electromotive force and intensity. However, this does not seem to be objectionable in arc-lighting, provided the pulsations are sufficiently rapid to prevent them being exhibited in the light to the eye. In fact it has been urged that such a current gives greater light effects for a given expenditure of power. The success of the Brush and of the Thomson-Houston machines, which are of the open circuit pulsating current class, points to that conclusion. Indeed, until we find the at present unknown dynamic value of light, and settle upon a more nearly perfect system of light measurement, the actual facts in these cases will remain unsettled and in dispute.

We have had handed to us a set of measurements made of this machine. They are tabulated below:

Weight of Machine, with base	2,250 pounds.
" " Armature with shaft	210 "
" " Wire on field magnets	285 "
" " " " Armature	85 "
" " Core of "	46 "
Size of wire on field magnets	No. 8 B. & S.
" " " " Armature	" 12 "
Diameter of field	11 inches.
Length " "	17 "
Total resistance of machine	8.6 ohms.
Resistance of line	11 "
External resistance, including 23 lamps	92.03 "
Resistance of lamps	81.03 "
Differences of potentials at binding-posts	805 26 volts.
Intensity of current	8.75 Ampéres.
No. rotations per minute	1,240
Power applied to engine, machine and belting	15.985 H. P.
Power absorbed in friction, by indicator card, no load	3.197 "
Power absorbed by engine	1.728 "
Probable power absorbed in friction with the full load	0.799
Power applied to production of electricity	11.989
Energy of current in external circuit $C \times E = 8.75 \times 805.26 = \frac{7,046}{746} =$	9.445 "
Energy of current in internal circuit $C^2 \times R = 8.75^2 \times 8.6 = \frac{658.43}{746} =$	0.882 "
Electrical energy in entire circuit	10,328 "
Percentage of electrical return $\frac{10.328}{11.989} =$	86 per cent.
Percentage of electrical return in external circuit	91 " "

The low resistance of the machine is specially noticeable. K.

The Theory of Magnetism.*

BY PROF. D. E. HUGHES, F.R.S.

(CONCLUDED FROM PAGE 134.)

Correlation of Forces.

There is at present a tendency to trace all physical forces to one, or rather a variation of modes of motion. In my last experiment the energy of my arm was transformed in the wire to molecular motion, producing evident polarity; this, again acted upon the ether, putting the needle hammer into mechanical motion. This, by its impact upon the glass bells, transformed its motion into sonorous vibrations; but this does not mean that we can convert directly sonorous vibrations into magnetism, or *vice versa*.

Let us take this soft iron rod. It seems quite neutral, although we know that the earth's magnetism is trying to rotate its molecules to north polarity at its lowest extremity. We now put it in mechanical vibration by striking it gently with a wooden mallet; the molecules at once rotate, and we have the expected strong north polarity.

Let us repeat this experiment by employing heat, and here again at red heat an equal strong north polarity appears.

Again we repeat, and simply pass an electric current, of no matter what direction. Again the same north pole appears. Thus these forces must be very similar in nature, and may be fairly presumed to be vibrations or modes of motion, having no directive tendency, except a slight, as in the case of electricity, for the same three forces render the rod perfectly neutral, even when previously magnetized, when placed in a longitudinally neutral field, as east und west.

Motion of the molecules gives rise to external magnetism to a rod previously neutral, or renders it neutral when previously magnetized; in other words, it simply allows the molecules to obey an external directing influence; the only motion, therefore, is during a change of state or polarity. If there is constant polarity there is no consequent motion of the molecules; in fact, the less motion of any kind that it can receive the more perfect its retention of its previous position. Consequently, constant magnetism cannot be looked upon as a mode of motion, either vibrating or rotary. It is an inherent quality of each molecule, similar in its nature to its chemical affinity, cohesion, or its polar power of crystallization. A molecule of all kinds of matter has numerous endowed qualities; they are inherent, and special in degree to the molecule itself. I regard the magnetic endowed qualities of all matter or ether to be inherent, and that they are rendered evident by rotation to a symmetrical arrangement in which their complete polar attractions are not satisfied.

Time will not allow me to show how completely this view explains all the phenomenon of electro-magnetism, diamagnetism, earth currents—in fact all the known effects of magnetism up to the original cause of the direction of the molecules of the earth. To explain the first cause of the direction of the molecules of the earth would rest altogether upon assumption as the first cause of the earth's rotation, and of all things done to the inherent qualities of the molecules themselves.

The mechanical theory of magnetism which I have advocated seems to me as fairly demonstrable as the mechanical theory of heat, and it gives me great pleasure to have been allowed to present you with my views on the theory of magnetism.

* Paper read before the Royal Institution, 20th February, 1884.

Electric Light Interests in Canada.

We published last week some details as to the test to be made at Toronto between the Toronto Electric Light Company, using the Excelsior system, and the Canada Electric Light Company, who intend to operate under the Van Depoele patents. A Canadian correspondent has forwarded us the latest information with regard to electric light interests in that city, and also in other cities of the Dominion.

The Toronto Company have already 50 lights in operation and are contemplating enlarging their facilities by the introduction of an Armington & Sims' 50-horse engine. There is a factory in Toronto making a specialty of this engine for electric lighting and general purposes. It is being rapidly introduced and is highly spoken of by every one who has either seen or used it.

The Canada Co. propose to start with 60 lights, and, unlike the Toronto Co., who import their plant, are establishing a factory for the manufacture of apparatus for lighting on the Van Depoele system.

The Ball Electric Co., late of London, Ont., now have their headquarters in Toronto, and have small plants running at Toronto Bridge Co.'s works, Moss Park Rink, and other places. Their specialty is a six-light machine, constructed on the so-called unipolar principle having two armatures and two commutators.

The J. J. Wright Electric Co. have had twenty-five lights in operation continuously since September last, but they propose to withdraw in favor of the Canada Co. and engage exclusively in the manufacture of lighting plant and carbons. They have a contract on hand to light the

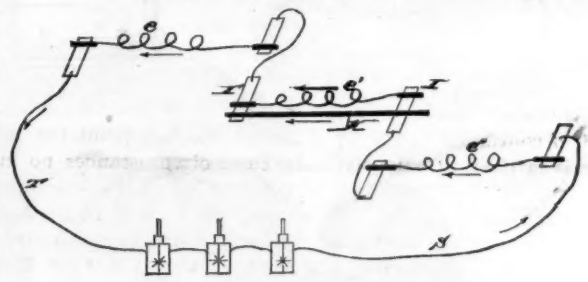

FIG. 4.

new glove factory in Acton, Ont., with arc lights. This installation will be unique, as it is proposed to locate the generator, and run it continuously, at a water power some distance from the factory, making it self-controlling and automatic in every respect, even to the oiling of the commutator from a reservoir of oil large enough to last a week or more at one filling. It will be used for both power and light. The machinery for the manufacture of carbons is nearly completed, and it is expected that carbons will be ready for the market early in May. This is the only company manufacturing carbons in Canada, so that, with an import duty of 20 per cent., if they make a first-class article, they ought to control the Canadian trade.

There is considerable activity in electric lighting interests in Montreal. The Royal (Thomson-Houston system) start out with a powerful organization and one of the best lighting systems in the world, and will no doubt take a leading place in the Dominion as manufacturers of electric lighting apparatus. Up to the 1st of February they had running in Quebec three 12-light machines and one 28; in Ottawa one 28-lighter, in St. Johns, one 12, and in Montreal a hundred and twenty-five lights to be increased at once to 300, with orders ahead at that time for three 6, five 12, and four 28. Others are coming in every day. Now the new organization is made, it is expected the business will be very largely increased.

The Phoenix Co. are also doing a good business and have just closed a contract for lighting St. Johns, Quebec.

In incandescent lighting, the Edison Co., of Canada, with headquarters at Hamilton, take first rank. Their latest contract is one to fit up the new upper lake steamers of the Canada Pacific Railway with incandescent lights.

Although competition is lively, there is a good outlook generally for electric lighting in the Dominion. The contests taking place between rival systems will undoubtedly result in the survival of the fittest, and in the meantime the public will get the benefit.

ONE MORE ACOUSTIC.—The following from the Boston *Herald:* "Still another short distance acoustic telephone is about to enter the field with claims of superiority above all rivals. It is said of it that the sender of a message over it can stand 20 or 30 feet from the transmitter and be distinctly heard at the other end of the line. No company has as yet been organized, so that it is too early to mention by name. The fact is given to show progress in telephone development, and the possibility of competition with existing telephones on short distances."

Fletcher's Patent Tell-Tale for Watchmen.

Attempts have been made by more or less ingenious men, says the English *Electrical Review*, to establish a mechanical record of the doings of watchmen during the night. Of late, these have practically resolved themselves into two methods of securing the same result—that is to to say, a time record of the visits made to certain determined stations. In one of these methods the watchman took a peg or key to the clock; in the other he took the clock or watch to the key. Of course, electricity has been tried in several instances, and a new arrangement has now been submitted to us which we think highly desirable to lay before our readers, inasmuch as it appears to be of an exceedingly simple character. At the central station there is placed a battery and an instrument to be presently referred to more fully. The battery is earthed on one side. From the other pole a conducting wire is carried in turn to each of the points to be visited by the night guardian in his round. At every one of these points there is a break of continuity in the wire, and at the last point the wire is earthed. Obviously under these circumstances no current can be transmitted along the wire. If the watchman, however, in going his rounds, joins over the wire at every station, he can, on his return, transmit a current, as the circuit will then be complete. It is evident that once having joined the circuit at every station, the watchman could go on transmitting currents for the whole of his watch, and that the apparatus would be good for one round only; but, by an ingenious contrivance, the act of sending a current breaks the circuit again at every station, and before another current can be sent, the watchman must again visit each station. Every current sent is recorded automatically on a paper carried by clockwork, so that mere inspection will show when the watchman made his rounds, and, in case he has missed a station, how long it took him to go back and mend his fault. At each station to be visited in his rounds by the watchman, the apparatus represented in Fig. 1 is erected, except the final station, where the apparatus shown in Fig. 2 is placed. Both of these apparatus are contained in neat walnut boxes, about 8 inches by 6 inches. At the intermediate stations the ends of the line wires are connected to two terminals. One of these terminals is connected to the armature shown in an angular position above the horseshoe magnet. The other is connected to a contact spring behind the white disc, so that in the position shown there is no circuit, and no current can pass the apparatus. To complete the circuit the watchman inserts a key through the door, and, turning a lever contained in the box above the armature, he depresses the armature into contact with the pole pieces of the magnet, the attraction of which holds it in position. On the end of the armature is a red disc, which then covers the fixed white disc, and thus gives the watchman an indication that he has established the circuit, and that his visit will be duly credited to him. The disc is rendered visible by means of the circular piece of glass shown in the door of the apparatus. Before proceeding to describe the other portions of the apparatus, we will suppose the watchman to have made his round, and to be about to transmit the recording current. Upon the pole of the magnet there are mounted two soft iron pole pieces, surrounded by coils of wire.

These bobbins are so wound that on receiving a current there will be induced in the pole pieces a contrary magnetism to that of the horseshoe, and the attraction of the latter for the armature will therefore be neutralized, when the spring pressing upon the under side of the armature near the pivoted end is enabled to force back the armature into the position shown, and thus the circuit is broken at every intermediate point at the same instant. The instrument in use at the last station is shown in Fig. 2. Here the watchman inserts his key as before, which then turns the commutator opposite the keyhole. By this action the circuit is completed, and at once a current of electricity flows along the line, and through each apparatus, with the result already described. If every station has been visited, and the circuit joined over in every instrument, the needle on the dial will be at once deflected; but if one or more stations have been omitted no current will be established, and the watchman must go over his round again. The needle standing at "dis" (disconnected), seen by the watchman through the glass in the door of the apparatus, is the signal for this extra job; but if the needle passes first to "on" and then to "off" he is made aware that all is right and ready for his next round. The record is permanently made by including an electromagnet in the circuit at any convenient place. This magnet governs a pencil, which traces a mark on a paper or card driven by a clock, so that a deflection will be produced on the diagram for every round completed. The positions of these deflections will show exactly how often and at what periods the man has completed his rounds.

To prevent the armature being shaken down or falling, otherwise than by legitimate means, a locking arrangement is provided. The points at which contact is made are self-cleaning, so that the circuit may not be interrupted by dust. The front of the lock is covered by a plate of glass (see Fig. 2), between which and the lock is inserted a piece of paper printed with a special design. This paper can only be inserted or withdrawn when the box is opened, and the key cannot be inserted without making a hole through the paper, and thus rendering any attempt at tampering with the apparatus at once apparent. To prevent a too-cunning watchman from joining over the instruments with pieces of wire and then sending currents at his will, all the connections are made inside the boxes, and nothing but insulated wire is available outside, so that an attempt at a fraud of this character would be doubly indicated, first, by the nature of the deflection made by the pencil, and, secondly, by the existence of bare wire at each side of the instruments. It is almost unnecessary for us to say that the system is applicable for every place where a watchman is employed. A typical method of the arrangement of the wire and stations is given in Fig. 3, which represents an actual installation. The dotted line represents one circuit or round, and the broken line another, the various stations being shown by small crosses. The system, which appears to us to be a most excellent one, is the invention of Mr. Fletcher, the telegraph engineer of the London & Northwestern Railway, and is now being carried out by the sole licensees, Messrs. Blakey, Emmott & Co., of the Northern Telegraph Works, Halifax.

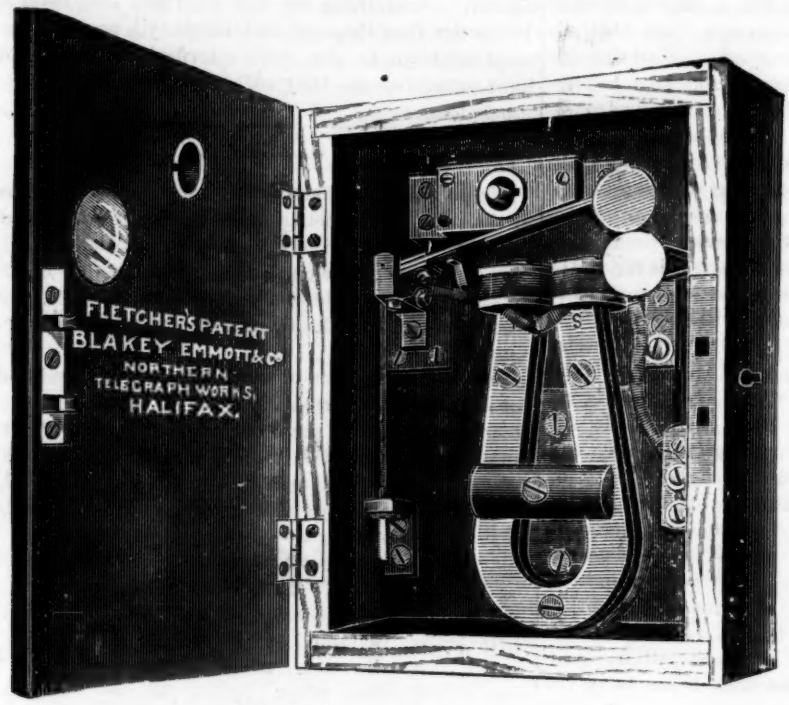

FIG. 1.

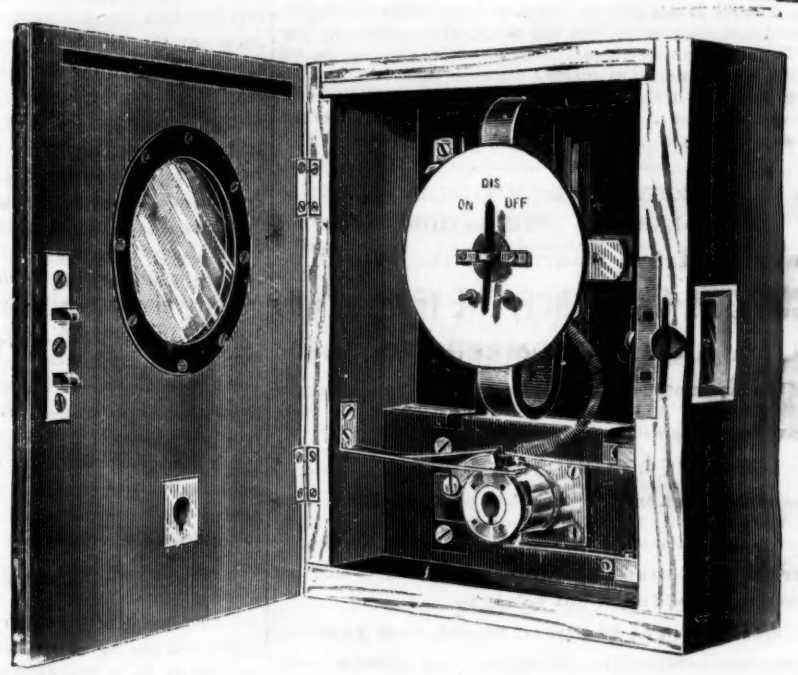

FIG. 2.

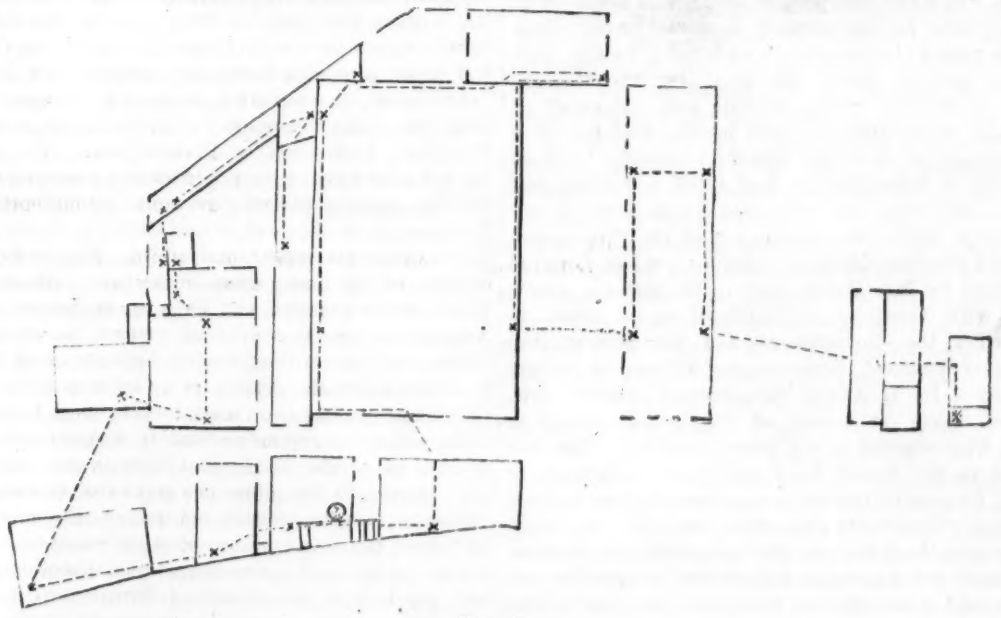

FIG. 3.

A Wonderful Electric Disc.

It is to be regretted that some great inventions do not always realize the expectations entertained about them. The "electric disc," particulars with regard to which we reproduce from the Boston *Budget*, may be of that class:

"It is rumored that a syndicate representing over $100,000,000 has been formed for the purpose of developing and introducing an invention which is said to combine the usefulness of the telegraph and the telephone with that of the electric light. The plans of the company, for some unexplained reason, are kept very dark, and the possibilities of the invention are somewhat indefinite; enough so to challenge doubt of the reality of the whole thing, if the claims put forward by those who talk about it were not so positive and evidently serious. One gentleman, who said he was not at liberty to state the names of the inventors or to go into particulars at present, said: 'The electric light will soon be a thing of the past. The disc is an electric apparatus, and by it we, in the night time, can receive sunlight from any point of the earth where the sun is shining. Don't be incredulous, my friend; sunlight has already been transmitted to a dark room over a wire; I have seen it myself.' Then, too, scenes of any kind, in action or in repose, however distant, which can be focused on the disc at the transmitting end of the wire, are registered with photographic accuracy on the the disc at the delivery end.

"These particulars are all given, with more or less positiveness, by other persons, who seemed able and willing to talk about the invention. None of the parties interviewed, however, would give the inventor's name or localize the invention in any way. except by saying that it originated in Boston."

TWELVE HUNDRED "MONOPOLISTS."—The last quarterly dividend of the Erie Telephone Company, $48,000, was mailed to 1,224 stockholders.

OUTPUT OF TELEPHONES FOR APRIL.—The output of Bell telephones for the month ended April 20 was 4,483, against 3,252 the previous month and 7,342 in the corresponding month of 1883. The total output for two months this fiscal year is 7,735, against 12,081 in 1883.

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NEW YORK, MAY 3, 1884.

A CONTRACT SYSTEM OF POSTAL TELEGRAPHY.

A great many propositions in regard to Government or postal telegraphs have been laid before the country and Congress during the last nine months. For instance, there was Senator Edmunds' plan, one of the first, proposing that the Government should build, own and operate lines for itself. This, on its broad grounds, has had the support in the House of Mr. John A. Anderson, of Kansas, whose idea is that "as a business proposition, it will certainly be cheaper and better for Government to operate its own lines than to contract for service," and who thinks that good lines enough could be built by the Government for $6,000,000, "the interest and principal of which would as certainly be paid by the earnings of a postal telegraph as that the Republic endures." Then Senator Hill, of Colorado, has had a bill providing that the Government could buy out existing companies or else build for itself under the supervision of the Postmaster-General and associate officers. Another project, fathered in the Senate by Mr. Dawes, was to incorporate a new company, with Gardiner G. Hubbard at its head, to contract with the Government for the performance of telegraphic business, between post offices, at certain fixed rates. In a shape not greatly unlike this, offers were made on behalf of the Postal Telegra ph Company, who wanted a ten years' contract. The bill introduced in the House by Representative Sumner, of California, proposed a Government system and authorized the Postmaster-General to proceed at once with the work of constructing the lines. It also proposed the issue of national bonds, not exceeding $25,000,000, to meet the expense. Beyond these schemes, there have been one or two others, of minor importance, and more or less following their main lines.

We have carefully enumerated the various propositions in order to refresh the memory of our readers who have not noted closely the progress of the agitation on the subject, The interest of the bills appears now to be historic chiefly, as not one of them has been accepted, and the session has wellnigh run out. Moreover, the House Committee on Post-Offices and Post Roads has at last agreed unanimously upon a contract postal telegraph bill, and it is not exactly the measure that some people have been expecting. The leading section, relative to rates, is this:

The charges for the transmission of telegrams, excepting service and Government telegrams, shall be prepaid by telegram stamps or stamped paper, and the maximum rates for telegrams of 20 words or less, exclusive of date, address and signature, when the distance of transmission is 1,500 miles or under, 25 cents; for every 250 miles or fraction thereof in excess of 1,500 miles, an additional rate of 5 cents may be charged; and between the cities of New York, Philadelphia, Boston, Baltimore and Washington, and such other points separated by short distances as may be from time to time designated by the Postmaster-General, the rate shall not be over 15 cents, day or night, provided that no rate shall exceed 50 cents; for telegrams to be transmitted by night, except as above stated, the charges shall be one-half the day rates. All words shall be counted except the date, address and signature, and for every five additional words or less one-fifth additional rate may be charged.

It is provided that no contract shall be made with any company that has not 1,000 miles of telegraph in actual operation; and further, that for failure or neglect to transmit any message, the contracting company shall be liable to the parties injured, in the penal sum of $100, together with the actual damages sustained, recoverable in a civil action.

The noticeable feature about this bill is that it is what our English cousins are accustomed to call "non-compulsory" or "permissive." In other words, as all the sections have been eliminated that provided for the construction of a Government system in case no contract was made with a company, the coercion that was to bring the existing companies down to the schedule of rates has been removed. If there were Government lines working at low rates the companies would have to yield.

As we have consistently opposed Government telegraphy since the movement in its favor was started, it is not without satisfaction that we see the attempts to commit the country to it fail one by one, and narrow themselves down to this mild scheme now outlined. The contract system, such as applies already to the carrying of the mails, is the least objectionable of any put forward, and there is no great reason why it should not be a success. In the event of trouble, loss and public discontent, it can be abandoned on the expiration of the contract, or other contracts can be made; and the country will not be adding, at enormous cost, to its multitudinous array of office-holders. Even as the matter stands, it must be admitted that a scheme which will not cover all kinds of "business," commercial as well as private and social, is sure to meet with general disfavor. It will not be sufficient simply to enable people to stamp their telegrams, put them in a post-office box, and then leave them for transmission at some indefinite time.

But the slips 'twixt the cup and the lip are proverbial, and it is not yet certain that the country will have even a contract system. The Senate bill, in its latest shape, provided for a Government line in case no contract was made with a company, but the House Committee has put on record its determination not to approve the outlay of national funds in that manner. Political issues also complicate the question this campaign year, and becloud the prospect greatly.

HOUSE BILL, NO. 2,655.

It is to be hoped and desired that Congress will see fit to approve House Bill, No. 2,655, which was introduced by Mr. William Mutchler, of Pennsylvania, has been unanimously agreed to by the House Committee on Commerce, and makes provision for the appointment of a Government Commission to conduct a national conference of electricians in connection with the approaching International Electrical Exhibition at Philadelphia. The details of the bill have already been laid before our readers, but we take this opportunity of expressing our pleasure at the appearance of an excellent editorial article on the subject in the Philadelphia *Ledger* of April 30. It is the first support worthy of the name, accorded by any influential daily paper to the scheme, and its sober statement as well as weighty argument cannot be without beneficial results. After pointing out the growing importance of electricity, it contends that the present is by no means the first time that Congress has been called upon to aid and countenance scientific research; and it makes reference to the work done by the Naval Observatory, the Coast Survey, the expeditions to explore the depths of the Atlantic and Pacific oceans, the reports on solar eclipses and transits of Venus, the accumulation of meteorological data by the Signal Service, and the investigations, in which the country had the help of the Franklin Institute, into the composition and resisting strength under strain of iron and steel. To such a list as this we might add the work done on some departments of the Census Returns, the experiments of the Agricultural Bureau, and the help accorded to electromagnetic telegraphy in 1843.

The demand of Congress for a return on the expenditure is natural, but Congress may rest assured that if it will thus help electrical science, the practical applications will take care of themselves, as the fructification of new or more accurately determined principles. The sum asked for is the merest trifle, and yet much can be done with it.

PATENT LEGISLATION.

The recent outburst of indignation on the part of inventors, patentees, mechanics, manufacturers and enterprising capitalists, against the proposed legislation on patents, has had a marked effect. In the House of Representatives, sounder and more moderate views prevail than when the confiscatory bills were hurried through, and it is not unlikely that later action will be less precipitate and prejudicial. In the Senate, all the bills containing provisions hostile to patents have been recommitted to the Committee on Patents for further consideration.

Another and more agreeable side to contemplate of patent legislation is that relating to the treaty between this country and several others, now before the Senate, which aims to effect, practically, an international patent union with a bureau in charge of the Swiss Government. Under the stipulations of this treaty, and the regulations of the Union it establishes, any one who has registered an application for a patent in his own country would have the prior right to register a similar application during a period of six months—or seven months for countries beyond sea—and would be able to obtain and utilize foreign patents with as much advantage as his home patent, This treaty applies to trade marks as well as to patents, and promises to be very valuable to the inventor. Something of the kind has long been needed. We notice that England and Germany have not yet given their adhesion to this new international union, but it is hard to believe that they will withhold their co-operation much longer.

OLD CABLES AND NEW.

We publish elsewhere in this issue a few cuts illustrative of the new cables being made for the Commercial Cable Company by the Messrs. Siemens. They, with the description, supplement the copious information that has already appeared in our columns on the same subject, and show what progress has been made in cable construction even since 1881.

In a few months the first of the new cables will be ready for business. We trust it may be a financial success, and there does not exist any cause why it should be a failure. An estimate has lately been made in England as to the volume of business that would be transacted, on a basis of twenty-five cents per word. The number of words that might be sent during the year is put at 30,000,000. Out of this the existing eight cables are allowed 20,000,000, leaving 10,000,000 for the new cables. Putting the capital of the eight cables at $64,400,000, it is estimated that out of their gross revenue of $5,000,000 per annum, they would only be able to pay a dividend of 3½ per cent. On the other hand, it is claimed that the new cables would pay over 25 per cent. This looks very rosy for the new company, who ought not to be unhappy if they get but 12½ per cent. The fifty cents per word rate pays, while the dollar per word rate did not pay, and it now remains to be tried how far new business can be created by the lowest rate of all. The experiment will be interesting and will be closely watched.

Now that cabling commands so much attention, we propose to publish soon one or two illustrated articles describing the manner in which cables are worked. We have lately received numerous letters asking for information of the kind, and will answer them in that way.

Music by Telephone in Germany.

It is becoming quite common now to transmit music by telephone. We gave recently an account of the reproduction of opera in this way for the King of Portugal, who was unable, through bereavement, to attend the opera in person at Lisbon. The German press is enthusiastic, according to an exchange, over the experiments now being made at the Philharmonic Society's office in Berlin, which has been put in such perfect telephonic communication with the distant opera-house that the effect of the music is reproduced without the loss or slurring of a single note, even of a Wagner composition. The music is dampened and it sounds as if the orchestra were separated only by a thin wall from the listeners holding the telephonic receivers to their ears. Listening to one act of "Tannhäuser," an auditor says that before the orchestra commenced playing, the voices of the audience could be heard, the tuning of instruments and the noise caused by the chairs being dropped to seat the audience.

Herr von Perfall, the manager of the theatre at Munich, has a telephone line built to his villa at Tutzingen, on the Starnberger Sea, and there he not only listens to the play, but also to the public applause. A very curious experiment was recently tried with great success. Connecting the Tutzingen villa of Manager Perfall with Munich and Oberammergau, the length of the line being ninety-five kilometers—about fifty-four miles, in Oberammergau, where the pupils of the school were rehearsing for the "Passion" play, the songs and talking were plainly heard. During the day the teacher spoke to the people in Munich or played for them on the piano or violin. In the evening the actors met the teachers and sang, the voices being distinctly heard.

At Tutzingen, at the house of the Inspector of the Glass Palace, the inspector's wife was stationed at the telephone. From Munich her husband asked her to take part in a song, the different voices comprising which were to come from Munich, Oberammergau and Tutzingen. First it was a solo from Tutzingen, then a duet between Tutzingen and Oberammergau, and finally a trio between Tutzingen, Munich and Oberammergau. None of these distances are great, but it is the frequency and ease with which the thing is done that strikes the popular mind.

How to Construct a Galvanometer.

BY THOMAS R. TALTAVALL.—PART II.

The band must now be fitted to the box. It can be bent into its proper shape quite easily, but care must be taken that it fits as closely as possible. This is necessary in order to utilize all the limited space around the needle. Fig. 7 shows the copper band bent into its proper form.

Now take a strip of thin paper the width of the band and cover the entire surface of the latter with it, excepting the narrow strips; it is not necessary to cover them. Cut the paper long enough to allow the ends to overlap, and fasten the latter together with any adhesive substance. Fit the paper as snugly as possibly. The object of this covering is to secure more perfect insulation between the band and the wire which is to be wound thereon.

We have now reached the stage of our work which requires much patience, and the utmost care and precision, namely, the winding of the wire which is to constitute the various coils.

Before we proceed any further, we should decide on the number of coils our instrument is to have, and their resistances. Five coils of 0, 1, 10, 50 and 100 ohms resistance respectively, as has already been stated, is a common subdivision of galvanometer coils, and, as they make a very serviceable instrument, let us adopt them in our plan.

We have already the coil of no resistance in the copper band. Now we come to the one-ohm coil.

How are we to determine the proper gauge and length of the wire to be used? Our aim is to secure the greatest possible magnetic intensity around the needle for the least expenditure of space. We cannot use wire with a large cross-section because it would take up too much of our limited and valuable space, nor can we use too small a wire because it would not fill space enough. A little calculation, involving the dimensions of our instrument, proves that No. 28 wire will most nearly fulfill our requirements. Insulated wire is, of course, understood. All the wire we shall use must be insulated. Silk insulation is the best.

It takes 19 feet of No. 28 wire to measure a resistance of one ohm. Therefore these figures represent the proper length and gauge of wire to use for our one-ohm coil.

In the process of winding the various coils the following rules should be strictly observed:

Always hold toward you that end of the frame at which the narrow strips of copper are situated.

In winding the wire around the box always wind it *from* you on top and *toward* you underneath. It is, of course, understood that the wire is to be wound in the space between the upright pieces of the frame.

Always begin a new coil at the point at which the preceding one ends, as though the winding were continuous and uninterrupted.

In winding the individual coils an equal number of convolutions should, as nearly as possible, be wound on each side of the box—that is to say, one-half of the wire on each side.

The magnetic effect on the needle will be the same whether we wind the convolutions of wire from the right side to the left, or from the left to the right, so long as the winding is in the same direction, that is, *from* you on top of the box and *toward* you under it.

The convolutions must be parallel to each other and as close together as possible.

When one layer is completed, filling the width of the space, wind the next layer back to the starting point, and so on, from one side to the other, and then back again.

With these important rules borne in mind we can begin the winding of the coils, that of one ohm first.

For convenience, begin to wind at the left side, close up to the frame, leaving 6 or 8 inches of the first end of the wire hanging loose. This length of wire is intended to connect the beginning of the coil with its proper binding post. Secure the loose end by running it through a small hole in the left-hand upright piece, under the box, and tag it with the words "beginning of one-ohm coil." By this means we can find it among other loose ends when we want it again. The preservation of the individuality of these wires is of the utmost importance.

As the wire is 19 feet long, nine and a half feet of it, minus the length of the ends, must be wound on each side of the box. The entire length will just about cover the surface of the latter with one layer. It is not necessary to wind any wire at the centre. A space equal to the width of the narrow copper strips may be left uncovered. The reason for this will be explained later on.

At the finish of the winding, leave 6 or 8 inches of the end unwound, and secure it through the right-hand upright piece in the same manner as we did the first end. When this is done, tag the end with "end of one-ohm coil."

For the 10-ohms coil about No. 34 wire should be used. This gauge is about $\frac{1}{140}$th of an inch in diameter. One ohm measures four feet and seven-tenths in length. Ten ohms will be 47 feet long. Wind in the same manner we did the preceding coil, not forgetting to begin at the point at which we ended that coil. Leave a few inches of the two ends hanging loose; secure them as we did the ends of the one-ohm coil, and mark them "beginning of 10-ohms coil," and, "end of 10-ohms coil," respectively. For the 50 and 100-ohms coils No. 36 wire is best suited. Finer wire might be used with advantage if it can be obtained. No 36 is exceedingly small in diameter, being about the thickness of a hair. It takes but one foot and fifty-five hundredths to make an ohm of resistance. The fifty-ohm coil will require 77½ feet of this wire. This coil will necessarily consist of several layers. As it would be inconvenient to wind one half of the wire on one side before winding any on the other, the same results can be attained by winding a layer first on one side and then on the other, then back again, and so on alternately to the end. Care must be taken to wind as nearly as possible the same number of convolutions in each half-layer. Leave unwound the proper lengths of the two ends and secure them as was done with those of the two preceeding coils, and mark them with their proper designations. In winding the 50 and 100-ohms coil we will probably experience a little difficulty in handling the fine wire. Care must be taken to not let it "kink," as there is greater danger of its breaking where it is so twisted. Should we by accident break the wire, the proper way to reunite the ends is to bare them of their silk covering for an inch or two, polish their surfaces well with fine emery paper, then splice them together as neatly as possible, gently but firmly twisting the ends one around the other to insure good contact. After splicing, the joint should be wrapped with a strip of oiled tissue paper to restore insulation. Tissue paper dipped in melted paraffine, or paraffine oil, is about as good as anything we can use for this purpose. Difficulty may also be encountered in measuring off the proper length of wire. The easiest and safest way to do this is to stick two pins firmly into a board or any other article of wood, say five feet apart. By winding the wire around the pins 15½ times we will get the right length for the 50-ohms coil, and as we wind it on the frame we can unwind it from the pins. In measuring the wire for the 100-ohms coil, if space will allow it, the pins might be placed 10 feet apart. At this distance 15½ windings will

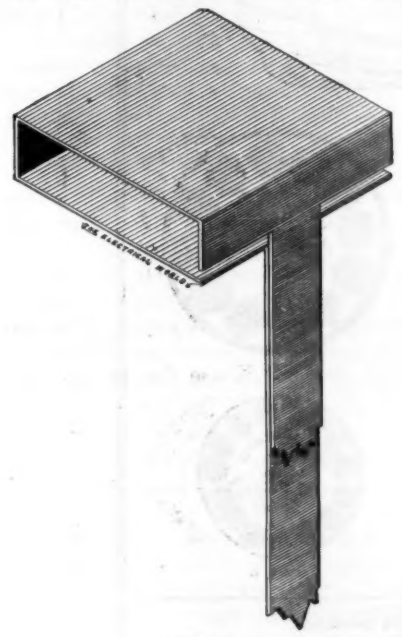


FIG. 7.

give us 155 feet, the required length for 100 ohms. Wind the 100 ohms coil as we did the one of 50 ohms, and in accordance with the rules laid down, securing the ends and properly marking them. If we have much wire left we need not limit the resistance of the last coil to 100 ohms, but continue the winding. The more wire we surround the needle with the more sensitive will be the instrument. If the coil is to be extended in length the extra wire should be measured by the aid of the pins so that we may know about how much resistance the coil will have.

All the wire we need should not cost more than 75 cents at the most. It can be purchased of any instrument maker.

It should be explained here that the resistance of the coils of our instrument will not be exactly what they were intended to have, but will be only approximately correct. The reason for this is that the resistance of the given lengths of the different gauges of wire used is variable, according to the degree of purity of the copper. These lengths of pure copper wire would measure exactly one ohm; but the copper wire of commerce is not pure. It all contains a slight percentage of impurity. The actual resistance of the coils therefore is likely to be a little short of what they represent. The difference, however, will not be enough to impair the value of our instrument for general use. When the winding is completed the entire external surface of the coil should receive an application of melted paraffine. Then the whole should be placed in an oven hot enough to melt the paraffine and allow it to permeate the interstices between the wires, but not hot enough to damage the silk covering of the latter or char the wood of the frame. Repeat the operation, applying a fresh coat of paraffine each time, until the coil is thoroughly saturated.

While it is not absolutely essential that the paraffine treatment be carried out, it is recommended for two very good reasons; first, it gives better insulation to the individual convolutions, and, second, it holds them firmly in place, thereby lessening the possibility of their getting loose and displaced. The instrument will do just as good work with or without the paraffine, therefore it is left to the option of the one making it which course to pursue.

A paraffine candle will furnish an abundant supply of that material for our purpose.

After the baking process is finished the next step is to connect the coils together in such a manner that any one of them can be used independently of all the rest, or all together as one coil.

[TO BE CONTINUED.]

How the B. & O. Put up Their Poles.

The B. & O. Company have been putting up poles in lower Broadway. The *Sun* describes their methods as follows:

At 9 o'clock last night a gang of forty men carrying lamps, picks, crowbars, and earth-packers walked down lower Broadway and stopped at the corner of Exchange place. A well-dressed man pointed out a spot on the narrow walk on the south side of Exchange place, within two feet of the Exchange Court block, and immediately a part of the men broke up the walk with their crow-bars. Then the well-dressed man pointed out a spot on the same side of Exchange place, at the corner of New street, and another gang broke up the sidewalk there.

When the paving stones had been torn out the men with shovels began digging. The sidewalk along the south side of this street is about two feet wide, but the holes were dug on the corners, so that the spaces between the holes and the corners of the building were from sixteen to eighteen inches.

While the men were busy setting up a 16-inch pole, Capt. Caffrey of the First Precinct police came along.

"What are you doing here?" he said to the foreman of the gang.

"Putting up telegraph poles for the Baltimore & Ohio Telegraph Company."

"Have you a permit?"

The foreman produced a paper properly signed and locating the holes to the exact inch. The Captain could find no flaw in it.

"Why didn't you do this in the daytime?" he asked.

"We knew better than that. An injunction would have been served on us. We will have a wire strung by daylight. Then let them get us out if they can."

The foreman laughed in a quiet, comfortable way, folding the paper meantime and putting it in his pocket.

"There will be a fight over this to-morrow. This building belongs to the Astor estate," said the Captain.

"All right. We've got a cash reserve of $40,000,000 Guess we can stand it," said the foreman.

The wire will run through Exchange Place, New, Beaver and William streets. The poles are 16 inches in diameter, and reach to the top of the buildings along the route.

Since the above little scene transpired, however, an injunction has been granted by the Superior Court, restraining the company from erecting poles and wires thereabouts. In the suburbs of New York, too, the company have had difficulties to contend with. Between the hours of two and five o'clock on the morning of the 28th a gang of men in charge of Superintendent Wood, of the Croton Dam, cut down 65 poles recently erected by the company along the road at Yorktown and Croton Lake, Westchester County. It is said that these poles, which extend a distance of two miles, were cut by direction of Commissioner of Public Works Thompson for the reason that they had been erected on city property and without any permission having been given by him. The Western Union has a line through Yorktown and along the route taken by the Baltimore & Ohio Company. As far as Pine Bridge the poles of these two companies are on opposite sides of the road, those of the Baltimore & Ohio being next to the lake. Beyond Pine Bridge the poles of the companies are but two feet apart, those of the Baltimore & Ohio being eight feet higher than the Western Union's, so as to prevent any contact or entanglement of the respective wires. No wires had been strung on the poles that were felled by Superintendent Wood.

SACRAMENTO, CAL.—The exhibition of Thomson-Houston arc lights at Sacramento has resulted in orders from Sacramento capitalists for apparatus for 200 lights. The same parties have also taken the agency for the Thomson-Houston system for the Pacific coast, and will push the introduction of the system there most vigorously.

THE INTERNATIONAL ELECTRICAL EXHIBITION.—A skeleton programme, as below, has already been made. The grand opening of the exhibition at Philadelphia will take place at noon on Sept. 2 with formal exercises, which will be attended by the President and members of the Cabinet, various Senators, Congressmen and United States officials, the Governor of Pennsylvania and other public personages. On the 4th of September the meetings of the American Association for the advancement of Science will be begun. General meetings will be held in the mornings in the Academy of Music or Horticultural Hall, and sectional meetings of the association on different subjects will be held in the afternoon in various places. On the evening of Friday, September 5, the grand reception of the British Association and Royal Society, by the Local Committee, takes place in the Academy of Music. Two other receptions to the English societies and the representatives of other foreign bodies which may be here have been arranged for—one at the Academy of Fine Arts, the other a lawn party at Haverford College. Upon the evening of the reception at the Academy of Music, Horticultural Hall will be used as a dining-room. The Local Committee will be prepared to serve two thousand lunches.

The Commercial Company's Cables.

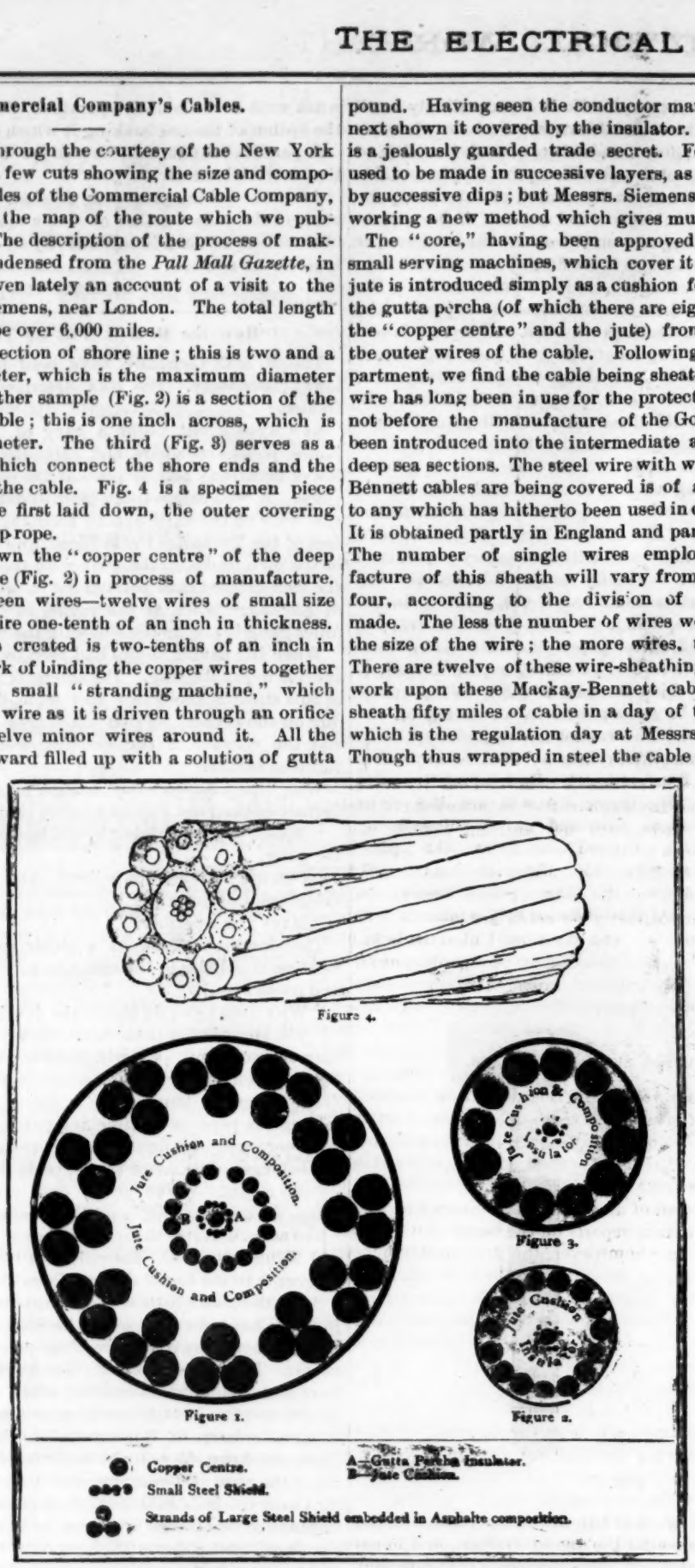
We are enabled, through the courtesy of the New York *Herald*, to publish a few cuts showing the size and composition of the two cables of the Commercial Cable Company, thus supplementing the map of the route which we published on Feb. 16. The description of the process of making the cables is condensed from the *Pall Mall Gazette*, in which paper was given lately an account of a visit to the works of Messrs. Siemens, near London. The total length of cable made will be over 6,000 miles.

The first cut is a section of shore line; this is two and a half inches in diameter, which is the maximum diameter of the cable. The other sample (Fig. 2) is a section of the great body of the cable; this is one inch across, which is the minimum diameter. The third (Fig. 3) serves as a type of the links which connect the shore ends and the deep-sea portion of the cable. Fig. 4 is a specimen piece of the Atlantic cable first laid down, the outer covering being uncoated hemp rope.

First, we are shown the "copper centre" of the deep sea part of the cable (Fig. 2) in process of manufacture. It is formed of thirteen wires—twelve wires of small size coiled around one wire one-tenth of an inch in thickness. The conductor thus created is two-tenths of an inch in diameter. This work of binding the copper wires together is performed by a small "stranding machine," which grasps the principal wire as it is driven through an orifice and fastens the twelve minor wires around it. All the interstices are afterward filled up with a solution of gutta percha. There are ten of these stranding machines at work upon this cable, and these can together turn out fifty miles of copper centre in a day of twenty-four hours. Breakages of wire are rare. The copper used, of course, is of the best quality. It comes principally from Lake Superior; where this is not so it is a copper purified by a solution process. Messrs. Siemens generally buy the copper in the wire form. They are now using it at the rate of forty tons per week. There is more weight of copper in the cable now being manufactured than in any other cable previously turned out.

The secret of success in cable making lies in the preparation and application of the gutta percha which forms the insulator. If the manufacturer makes indifferent work in this part of the cable he fails in every part. The visitor is first shown the gutta percha as it stands stacked in peculiarly shaped blocks, and then he sees it torn into small pieces by a large cutting wheel and thrown into a pit. Next he is introduced into a large apartment, where he follows the gutta percha as it goes through three important processes—first, kneaded, softened and cleaned in water, where it remains for two or three hours; then masticated, and finally strained. All this is done by powerful machines, of which there are probably three dozen; indeed, three engines of 600 horse-power, are required in this department alone. The hydraulic strainer through which the gutta percha finally passes exerts a pressure of 2,000 pounds to the square inch, which gives as a result a very thin cake of impurities curious for the designs accidentally impressed upon it. The high character of the gutta percha purchased is testified to by the fact that the impurities extracted throughout the whole of the processes do not exceed twenty per cent. The "g. p." is imported, both directly and indirectly, from the Dutch islands in Java and from Sumatra, costing in its raw state close upon 75c. per pound. Having seen the conductor manufactured, we are next shown it covered by the insulator. How it is covered is a jealously guarded trade secret. Formerly insulators used to be made in successive layers, as a candle is formed by successive dips; but Messrs. Siemens are credited with working a new method which gives much superior results.

The "core," having been approved, is conveyed to small serving machines, which cover it with jute. This jute is introduced simply as a cushion for the protection of the gutta percha (of which there are eight layers between the "copper centre" and the jute) from the pressure of the outer wires of the cable. Following on to another department, we find the cable being sheathed in steel. Steel wire has long been in use for the protection of cables, but not before the manufacture of the Gould cables had it been introduced into the intermediate as well as into the deep sea sections. The steel wire with which these Mackay-Bennett cables are being covered is of a quality superior to any which has hitherto been used in cable manufacture. It is obtained partly in England and partly from Germany. The number of single wires employed in the manufacture of this sheath will vary from twelve to twenty-four, according to the division of the cable being made. The less the number of wires worked in, the larger the size of the wire; the more wires, the less their size. There are twelve of these wire-sheathing machines kept at work upon these Mackay-Bennett cables, and they will sheath fifty miles of cable in a day of twenty-four hours, which is the regulation day at Messrs. Siemens' works. Though thus wrapped in steel the cable is not yet finished; still further protection is deemed essential. It is covered next with coatings of a black asphaltic composition, solidity being given to this by the introduction of layers of broad tape, rolled off a disc which hangs below the ever-traveling cable. First there is a coating of composition, then a layer of tape, and so on until three coatings of composition have been laid upon the cable. Then the cable is complete. So far it has been the making of the deep sea section of the cable which has been described. The shore end section may be said to be a cable within a cable—a layer of jute and coatings of composition lying between the two steel armatures. The nature of the two kinds of intermediate types may be judged from these descriptions. But it may be noted that in regard to size and character of conductor and insulator all the types are alike.



THE COMMERCIAL COMPANY'S CABLES.

American Institute of Electrical Engineers.

We publish below the circular that has been sent this week to all who have, up to the present time, signed the call for the organization. We understand that the signatures and applications for membership already number over two hundred—a fact most significant as to the need generally felt for such a society:

DEAR SIR: As you have signed the call for organization, signified your desire to become a member, or have been suitably proposed for membership in the American Institute of Electrical Engineers, you are hereby notified that the committee on organization appointed by the chairman of the meeting held on the 15th of April, has completed a scheme of organization and will be ready to report the same to a meeting of those to whom this notice is addressed.

Said meeting is hereby called for Tuesday, May 13, 1884, at 8 o'clock P. M., at the rooms of the American Society of Civil Engineers, No. 127 East Twenty-third street, New York City, for the purposes of consideration of the committee's report, adoption of rules and the election of officers. You are hereby cordially invited to attend and take an active part in the proceedings.

The committee recommends that professional electrical engineers and electricians, and all persons interested in electrical enterprises or studies shall be eligible for membership or associate membership, either as members or associates; that the entrance fee shall be five dollars and the yearly dues ten dollars; that the affairs of the Institute be managed by a board of officers, called the Council, to consist of a president, six vice-presidents, twelve managers, a secretary and a treasurer, and that this board shall elect and determine the status of members—whether as members or associates.

It also recommends that three or more general meetings be held each year; that the office of the Institute be established in New York City; and that headquarters be provided at or near the International Electrical Exhibition buildings in Philadelphia during the exposition, from Sept. 2 to Oct. 11, 1884, for the use and convenience of the members.

Extraordinary interest has been shown by persons engaged in electrical matters in the welfare of the Institute, and the committee believes that the meeting will be a memorable one.

Applications for membership should be addressed to N. S. Keith, P. O. Box 3332, New York City.

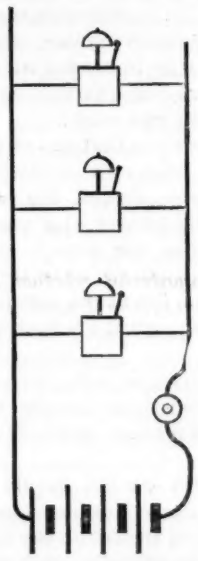
N. S. KEITH,
W. A. HOVEY,
W. H. ECKERT,
GEO. A. HAMILTON,
GEO. L. BEETLE.
} Committee on Organization.

NEW YORK, April 30, 1884.

New Method of Constructing Circuit of Electric Gongs.

To the Editor of The Electrical World:

SIR: Having occasion some time since to construct a circuit of nine electric gongs, all to be rung from one battery and push button, and the farthest, some 2,000 feet from the battery, after some little experimenting, and knowing they could not be successfully worked on one continuous circuit, I run out two main wires from my battery and push button, and legged the bells in like the rounds of a ladder. This method has been in operation some four months and gives perfect satisfaction, the bells ringing as loudly and steadily as though there was but one in circuit. There seems to be no diminution in power in the bells farthest away from the battery; the one farthest away ringing as strongly as the first.



This may be accounted for by the fact that the circuit is being continually opened at each bell, not only allowing the main current from the battery to flow by and into the other bells, but augmenting the strength of the current by the energy which the bell magnets have accumulated and which the breaking of the current discharges into the line.

I find this method so successful that as I have never heard of its being used before I send it to you in hopes that it may be tried by some of your many readers.

C. G. TOMPKINS,
Supt. New England Telephone & Telegraph Co.
PITTSFIELD, Mass., April 6, 1884.

Priority of Telephone Invention.

To the Editor of The Electrical World:

SIR: In your issue of April 19th I see illustrations of Mr. Daniel Drawbaugh's early forms of telephonic apparatus, accompanied by an editorial and several comments of European contemporaries. I am pleased to have even so meagre an account of Mr. Drawbaugh's experiments prior to the earliest date of Mr. Bell's *invention* (?). The cuts are very comprehensive and show what can be accomplished by "*an uneducated workman living far distant from the world of thought and action, and the whole accomplished within a period of ten years.*" It shows, as does the history of some of our greatest inventions, that it is not always necessary for an inventor to be specially educated in the line of research to which his invention

pertains. It is but another illustration of the well-known fact that our "Electric Science" is to a great extent the outgrowth of the untiring experiments of men both educated and uneducated, whose primary occupations are vastly different, many being such that one would not expect to find them in this field at all.

It shows also that the fruits are often bestowed upon others than the first inventors. I do not mean nor wish to be understood as undervaluing the efforts of Prof. Bell, or their results. Considerable stress is laid on the apparent similarity of Drawbaugh's instruments, with those of Bell and more recent inventors, and this is made to appear strongly against the probable genuineness of these instruments, as to the date of their earliest construction. But laying aside the testimony of one hundred and forty-five witnesses (which it seems to the writer is of considerable value) we see no reason why such should not be the truth.

Your writer is acquainted with a few instances which bear on this point, notably that of the invention of the steam whistle, substantially as now used, made many years before the date of the invention, according to present accounts; and the first inventor died knowing that the invention was his own and credited to others. He was a a *poor* inventor. This same man invented the machine for preparing buckwheat for grinding by removing the hull, twenty-five or more years before its recent invention. Nobody but his neighbors knew, or know it. But to return to our own case, compare the description of a telephone receiver found on page 142 of "Wonders of Electricity" with that of Bell's first patented receiver and transmitter. The only difference is that the telephone made after this description "by one versed in the science to which it belongs," and "without the aid of anything not known at the time of its public description," is far ahead in point of perfection, and is exactly like Drawbaugh's of 1867 and 1868, illustrated at Fig. 5 in your issue before referred to. Of this being really an earlier invention than that of Bell's there can be not the slighthst doubt, as the book in question was translated from the French of J. Baile and published by Scribner, Armstrong & Co., New York, in 1872, making it a "*Printed description in a publication in this country*" in every sense according to the letter of the law, and four years prior to Bell's first invention.

It may be urged by some that this form of telephone will not work and that the writer and in all probability the inventor did not know that it would transmit or receive the human voice over a wire. In the famous decision of Judge Lowell he says to this effect:

"*It is now immaterial whether the inventor knew it* (Bell's first telephone) *would work or not, so long as it is now proven that the instrument will do the work.*" Now as to the working capabilities of the receiver described in the book above referred to. For the benefit of those not possessing it we will give the description, which is short but sufficient: "*At the extremity of the line the current enters an electro-magnet, which attracts another vibrating plate of size and quality identical with the former.* ATTRACTED AND REPELLED *very rapidly, exactly, and as rapidly in fact as the plate* (of transmitter) *mentioned above, this second plate gives forth a sound, which will have the same mucical value as that of the other, as the number of vibrations per second is the same in both cases.*" I have only to say if Bell's or Drawbaugh's instruments work, this must work, and if Bell's patented instrument is anticipated by four years, as proven by this publication, it is not difficult to believe it may have been invented by Mr. Drawbaugh also, and at even an earlier date. As to Drawbaugh's magneto-telephone of 1870, Fig. 6, your issue of 12th, it can easily be seen by fair-minded investigators that it is only one step in advance of his receiver of 1867 and 1868, and that step is only the bringing of a permanent magnet to the rear of the electro-magnet, Fig. 5. This is a small step onward, and it is to be wondered at that his instrument was two years old before he tried it, for the result could have been foretold by all the known laws of induction. This is the only step or portion of the invention of the telephone your writer can, after thorough investigation, credit to Professor Bell, and this is not covered by the patent first issued to him and on which the foundation is laid. However, for it we are prepared to give him due credit. But we are ready at any time to be convinced that Drawbaugh preceded him even in this, providing reasonable proof is produced. And to us it seems that one hundred and forty-five witnesses, a large portion or all of whom are doubtless reliable persons, ought to be overwhelming proof of this fact. As to the transmitters of Drawbaugh and their likeness to those of very recent invention, we see but little difference between his early transmitter, Fig. 1 of your issue referred to, and that of Prof. Reis. The construction is the same, only that Drawbaugh interposed poor conductors between the metal electrodes. Of course there is nothing strange in this. In all his other and more recent transmitters there is no difference except in point of mechanical construction, each one being more convenient and of better appearance than its predecessor. These are only such improvements as any inventor with an eye for neatness and symmetry would make, and such as would suggest themselves to the mind of a person of inventive turn using these instruments, and still leaving a great deal to improve.

While the writer is absolutely uninterested financially in any of the telephones or systems of telephones, or of the many companies at present existing, he would nevertheless gladly see this telephone controversy settled fairly, and he would be glad to see, read and judge for himself on the evidence on which so important a decision must be made. C. E. PINELL.

COBLESKILL, N. Y., April 15, 1884.

A Reduction of Rates.

The keenness of the competition now going on in the telegraphic business is seen in the recent reduction of rates for "reds." The Western Union Company have announced that their rates for night business are 15 cents for 10 words, and one cent for each additional word between all competitive points east of the Missouri River. As most of our readers know, the rates heretofore have been two-thirds of the day rates. Recently the Bankers and Merchants' Company made a uniform night rate of 15 cents, and now the Baltimore & Ohio Company meet the demands of the crisis by offering to send night messages at the rate of 15 cents for 15 words, and one cent for every additional word. It is stated from Buffalo that the Postal Telegraph Company's "cut" is 15 cents for 20 words, and that the company have ordered a corresponding reduction to sections in the oil district. Apparently all the companies are prepared to fight it out along the line of low rates, if it takes all summer—and one more consolidation as the sequel.

The revised schedule of message rates issued by the Western Union Telegraph Company went into effect May 1. This new schedule embraces many radical reductions. Officers of the company explain that, in pursuance of their policy of making their tariff list uniform, reductions of from 15 to 30 per cent. have been made in the charges for messages sent to and from Southern points. For instance, rates that have heretofore been 75 cents are now 60 cents, and rates that were formerly 60 cents are now 50 cents. The highest rate now on the Western Union list is $1.07, which is the charge for a message of ten words sent from ocean to ocean. The reduced rates on night messages, which were announced several days ago, went into effect Tuesday night.

Bucket Shops in Chicago.

The Market Committee of the Board of Trade at Chicago have at length, after nearly a year's deliberation, perfected a plan by which they hope to effectually squelch the bucket shop business. By the new system the Board of Trade will take direct control of the publication of market reports; that is, instead of allowing the Western Union and other companies to take reports on the board and forward wheresoever and to whomsoever the transmitters please, the board will employ its own employés to supply the Western Union for transmission only to such parties as the board directs. The arrangements between the Western Union and the appointed committee of the board are now complete, and the scheme will be submitted to the Board of Trade directors for formal approval at their meeting at once. The new system was to go into operation May 1.

A dispatch of the 29th ult. from Chicago says: "At the meeting of the Board of Trade directors to-day, the directors wrestled for two hours with the proposed system of market reports designed to shut out the bucket-shops. President Blake, at the adjournment, admitted that a contract had been signed with one telegraph company, but refused to designate the company. The reason of this attempt at secrecy is the fear that an injunction will be obtained by the bucket-shops preventing the Western Union from taking out their wires and tickers before the contracts with the remaining telegraph company shall have been made. There is no doubt, however, that the Western Union is the company with which the arrangements have been completed, as E. H. Whitford, who will have charge of the new system, is an old Western Union man. He will be assisted by six reporters and four operators. The directors hope to have the contracts with all the telegraph companies signed by next Tuesday.

Counting Papers by Electricity.

The use of electricity as a means for counting and registering has naturally recommended itself to inventors, and the devices to this end are already numerous. Mr. George Rosquist, the machinist of the *Sun*, is the inventor of an electrical apparatus by which papers are counted and registered as they leave the steam presses. It is simple and complete, and has been in successful use on the *Sun* presses for several months. Unlike the other paper-counting apparatus now in use, which registers the revolutions of the cylinders whether the paper is running over them or not, Mr. Rosquist's apparatus only registers the actual number of impressions made.

On the male cutting cylinder of the press is fastened a bowed strip of brass about three inches long and one inch broad. On it is a button which connects with a bell crank, which works a small rod connecting with a circuit switch in a box on one of the cylinder's journals. The switch connects, by wires from a small battery, with an electro-magnetic apparatus constructed on the principle of the Morse telegraphic instrument. The pressing of the button works the switch, which flies back to its original position when the pressure is removed. This works the bar on the electro-magnetic apparatus, which connects with the register by a lever. The lever moves a geared wheel, which registers either two or four papers, depending on the size of the press. The registers for the double presses register as high as 999,000, and those for the single presses register 99,000.

In order to prevent the registering of revolutions of the cylinders when papers are not printed there is a small canal cut into the female cutting cylinder, into which the bowed strip of brass with its button sinks when the canal is not covered by the paper on which the impressions are made. The registers can be placed at any distance from the presses. Those used by the *Sun* are in the office of the superintendent of the paper department, on the floor above the presses.

Magnetization of Watches.

Mr. T. G. Ellsworth, of New York City, writes as follows: For some time there has been a general demand among electricians and others coming in close proximity to dynamo machines for a remedy to prevent the parts of watches from becoming magnetic, and therefore useless. I have known where works of expensive watches have been thrown away and new works substituted before a correct timepiece was restored. At the suggestion of Prof. Elisha Gray a Chicago jeweler recently made a watch which is claimed to be proof against injury by magnetism. It has a rim of electro-plated iron as a guard. Two watches, one with a guard or iron rim and one unguarded, were subjected to a test with strong magnets. The unguarded watch stopped instantly, but the other was not interfered with.

New Postal Telegraph Directors.

At a meeting of the directors of the Postal Telegraph and Cable Company, held on April 28, the number of the board was increased from 13 to 16, and the following gentlemen were elected to fill the positions so created: Joseph S. Stout, of the firm of Stout & Co., bankers, a member of the Stock Exchange, and a director of the Metropolitan Elevated Railway, and of the Shoe and Leather Bank; Emery M. Van Tassell, a prominent grain merchant, and member of the Produce Exchange, and Francis F. Robins, of the well-known firm of Robins & Robinson, bankers.

DEPARTMENT OF INQUIRIES.

While we are pleased to answer in this department all questions of general interest to our readers, and do so without charge for time or expense, we must request those of our patrons who desire information for their personal interest, and who cannot be properly answered in this way, to send us with their request a small sum, say from $1 to $5, to pay for the time and the expense incurred for their exclusive benefit.

47. DISTANCE OF MAGNETIC ATTRACTION.

"How long a distance is it safe to calculate that an electro-magnet will attract its armature?" G. H. E.
TROY, N. Y.

The strength of the attractive force of an electro-magnet at various distances, on a given area, varies *inversely* to the square of the distance. To illustrate: an armature is attracted at a distance 1 four times as strongly as at a distance 2, or nine times as strongly as at a distance 3, etc., etc. This is a rule which varies somewhat with the shape of the magnet and armature to which it is applied.

Strength of current, number of convolutions of the conducting wire, mass and shape of iron of the core, mass and shape of the armature, and the mechanical resistance to be overcome are all to be considered. Generally, with the amateur, experiments had better be tried, preliminarily, before making the accessory apparatus. For more nearly uniform effects over considerable space, axial, or solenoidal, magnets had better be used. See issues of THE ELECTRICAL WORLD for March 8, 22 and 29, 1884, for description of such magnets in connection with electric lamps. K.

48.—TROUBLE WITH TELEPHONE SYSTEM.

"Will you please inform me why a Blake transmitter (that has always worked well) suddenly gives out so that you cannot be heard very distinctly? The telephone is looped in on a line 30 miles long. I put on a new battery and examined the primary circuit all through and find it in good order. Tried the same battery on a line 60 miles long and it works perfectly. The secondary coil is all right, for the hearing comes clear and distinct. When I put the transmitter on a short circuit (through the call box) it appears, by tapping on the transmitter, to be all right, but when I cut the line in there don't seem to be much life in it."
BINGHAMTON, N. Y. W. G. J.

Try your primary circuit to make sure that all the connections are clean and solidly made. Then examine the electrodes of the transmitter. They may have their contact surfaces so distorted or otherwise disarranged by a severe jar or other cause that readjustment or even a substitution for one or both electrodes may be necessary. You are incorrect in presuming that the secondary coil is all right because the hearing is good in your receiver. It is the secondary at the other end which works that. Try another secondary coil in place of the one you have if you do not find the fault elsewhere.

Tapping the transmitter diaphragm gives too violent motion to the electrode to be a reliable test. K.

49.—INSULATED WIRE FOR INCANDESCENT WORK.

"What is the best kind of damp-proof wire, say No. 16 B. & S. gauge, for incandescent work, where it must be laid in fresh plaster? Clark's heavy rubber-covered is not permissible."
MINNEAPOLIS, Minn. J. W. L.

Kerite covered wire is best to stand damp plaster. We presume that rubber-covered is not permissible on account of its absence of fire-proof qualities. Bare wire in plaster after it has dried is sufficiently well insulated, and is also fire-proof within the specific limits. If the plaster is likely to remain damp, or to get damp at times, use a wire of sufficient size to stand the maximum of current without getting hot, insulate it well and cover it with a lead pipe to keep out moisture. K.

THE TELEGRAPH.

THE BROOKS UNDERGROUND SYSTEM.—We have an article in preparation on the Brooks system, now working in Philadelphia; but owing to unforeseen delays, we are not able to publish it this week as promised. We hope, however, to give it next week.

MR. C. S. H. SMALL, long connected with the Gold & Stock Co., has resigned his position with them of Assistant Superintendent, and has accepted the office of Superintendent of the Commercial Telegram Company. Mr. Frank Rae, hitherto Superintendent of the latter company, becomes General Superintendent.

COMPETITION IN NEW ENGLAND.—A dispatch from Hartford, Conn., of the 28th, says: In the matter of the petition of the Baltimore & Ohio Telegraph Company, to the United States Circuit Court, for an order directing the New York and New England Railroad Company to afford certain transportation facilities to the petitioners in the construction of their telegraph lines, Judge Shipman to-day dismissed the petition on the ground that the court was not warranted in disturbing an existing contract between the railroad and the Western Union Telegraph Company, under which the latter have exclusive facilities as against other telegraph companies.

DEATH OF GEORGE W. TRABUE.—George W. Trabue, the General Southern Superintendent of the Western Union Telegraph Company, died at the Coleman House, this city, soon after 7 o'clock on the morning of May 1, after a brief illness from brain fever. Mr. Trabue's headquarters were in Nashville, Tenn., where he was born, and where he had lived the greater part of his life. He had been in the employ of the Western Union Company since the close of the war. His wife died several months ago, and her loss was deeply mourned by him. Of late he has suffered much from nervous prostration and insomnia, and his visit to this city last week was for the purpose of arranging for a period of rest. Gen. Eckert gave him an indefinite leave of absence, with the friendly admonition not to worry about business until he was entirely well. Mr. Trabue leaves four children, the eldest of which is about fifteen years old. His body was taken to Nashville last evening, and will be accompanied home by Assistant General Superintendent Merribew and Col. Clowery.

THE TELEPHONE.

CLAY TELEPHONES.—It is said that the Bell Company have warned the subscribers of the Clay Company, of Philadelphia, against using Clay telephones.

THE UNION TELEPHONE CO.—According to the Boston *Herald* the Union Telephone Co. has delayed the declaration of the customary 1¾ per cent. dividend on account of a vacancy in the directory. It will probably be declared in a few days.

OPERATIONS IN THE WEST INDIES.—The special agent of the Tropical Telephone Company has returned to Boston from the West Indian Exchanges, and confirms the sale of the Trinidad property upon terms heretofore published. The deed has gone forward. He brings a proposition from leading Barbadoes merchants for the purchase of the plant there at a price which will net the Tropical about $15,000 cash and secure a permanent supply contract for the future. The Government of Martinique offers an exclusive concession for that island and a guarantee of 100 subscribers. The company will start an Exchange at St. Pierre. The company expects to have a surplus of $1 per share in the treasury July 1.

A BATTERY FOR TELEPHONES.—Mr. J. Edwin Sherman, of Sing Sing, N. Y., has invented a dry battery which he expects to revolutionize the working of the telephone. It is a little oblong box, 4⅛ inches by 1⅛, and three-quarters of an inch deep, and is attached to the instrument instead of the ordinary battery. By its use it is possible to carry on a conversation with a person 30 or 40 miles away, and to hear and be heard distinctly, as was shown lately by Mr. Sherman talking to a friend in Wall street while he was in his laboratory at Sing Sing. The inventor claims that his dry battery will last as long as the instrument without losing its power. He has had one in constant use for three weeks, doing work that would have used up the ordinary battery in 10 minutes.

THE ELECTRIC LIGHT.

A SAWYER-MAN INSTALLATION.—The Sawyer-Man Co., formerly at 11 Pine street, have moved to their fine new quarters in the magnificent building, just completed for the Mutual Life Insurance Co., fronting Nassau street, between Liberty and Cedar. They have placed eight large dynamos there, of 200 incandescent lights each, twenty candle-power, and one extra dynamo of 100 lights, making in all 1,700 twenty candle-power lamps. To run the dynamos, they have four Westinghouse engines of 55 nominal and 60 h. p. capacity. These are all placed in the sub-cellar, where they rest on the most solid foundations. We understand that the dynamos are the production of Mr. E. R. Knowles, the electrician of the Sawyer-Man Co. and the parent Consolidated Electric Light Co. Mr. Wm. P. Shinn is President of the Sawyer-Man Company, Mr. James Keith, Vice-President, and Mr. H. R. Garden, Secretary and Treasurer. These, with Messrs. Thomas C. Platt, Albon Man, Wallace C. Andrews, and Edwin S. Thayer, are the trustees.

THE EDISON LIGHT IN INDIANAPOLIS.—An exhibition of the Edison light was given at the Denison House, Indianapolis, on April 24, the offices and ladies' reception room being fitted up. This display was witnessed by many men prominent in the State and city, representatives of the press and others. As might be expected, all present were very much pleased with the pure, mellow light, and the sensation caused by the display appears to have been general. Lamps of 16, 32, 50 and 100-candle power were shown. They were fed by a 50-light dynamo, which was run by a 15-h.-p. Atlas engine. The exhibit included lights in various positions and in various styles—electrolier, sliding drop-lights, brackets, students' lamp, hall lamp, &c. The test was made under the superintendence of Mr. G. M. V. Taylor, agent of the Edison Electric Light Company and the Edison Company for Isolated Lighting, with offices at 21 South Meridian street, in that city. It seems to us that there is a wide field for prosperous business in Indianapolis and neighboring cities, and we judge from the reports of the trial that it will not be long before the demand created will be met.

MISCELLANEOUS NOTES.

ELECTRICAL UNITS.—A dispatch of April 28, from Paris, says: The conference to determine electrical units assembled here to-day. The proceedings were opened by M. Jules Ferry, Prime Minister. M. Louis Cochery, Minister of Posts and Telegraphs, is President. The delegates in attendance number 64, representing 26 States.

EDISON ON ELECTRICITY.—A dispatch of May 1 from Worcester, Mass., says: "T. A. Edison, the inventor, was the guest of the Mechanics' Association and the Natural History Society at a reception and collation at the Bay State House this evening. Previous to the reception he conducted the experiments at a lecture on applied electricity, in Mechanics' Hall, under the auspices of the two societies. Various systems of electric lighting were shown, as were the loud-talking telephone, the microphone, the phonograph, and the electric motor, as applied to railways, sewing-machines and lathes. The hall was crowded by a paying audience of 2,000 persons. The exhibition will be repeated to-morrow night for the benefit of students in the various educational institutions of the city."

STOCK QUOTATIONS.

Telegraph, telephone and electric light stocks were quoted as follows on Thursday at the Electric, Manufacturing and Miscellaneous Stock Exchange, and at the Stock Exchange:

TELEGRAPH.—Am. Cable, b 55, a 57; American Rapid, b 50, a 65; B. & M. Co., b 119, a 119⅝; Commercial Telegram Company Pref'd, a 109; Commercial Telegram Common, a 95; Harlem District Telegraph Co., a 5.50; Manhattan Telegraph, b 10, a 85; Mexican, b 125, a 147; Northern & Southern Tel. Co. 1st mtge bonds, b 74, a 78; Postal Telegraph (stock), b 6.75, a 7.00; Postal Telegraph bonds, 1st 6 per cent., b 55, a 55.50; Postal Telegraph and Cable Co., 13.50; Western Union, b 60⅝, a 60¾.

The features of the week have been the lower prices of Western Union and the failure of James R. Keene, the operator. It is stated as a fact that among the Western Union which came upon the market were 5,000 shares belonging to President Arthur. This stock, it is reported, has been carried for two years, and was guaranteed at 80.

Of Mr. Keene, it was reported that he sold "puts" on 2,000 shares of Erie at 22 and on 2,000 shares of Western Union at 68. On the 30th Erie was down to 18, and Western Union touched 61⅜. One person who held "puts" for 500 shares of Western Union was said to have sent word to Mr. Keene that the shares would be "put," and that he (Mr. Keene) would be required to "face the music." It was further stated that one of Mr. Keene's representatives made reply that the holder of the 500 shares "had better put them in the market or wait a day or two for Mr. Keene to take them." It is said that Mr. Keene will meet all his engagements later on.

TELEPHONE.—American Bell, b 162, a 163; American Speaking, b 110, a 125; Currier Telephone Bell, b 3; Colombia and Panama, b 24.50, a 25; Continental, b 15; Dolbear, b 5, a 10; Erie, b 30, a 31; Globe, b 5, a 8; Hudson River, b 60, a 90; Inter-Continental, b 95, a 1.25; Mexican, b 2.50, a 3.25; Mexican Central, a 2.50; Molecular, b 9, a 10; New England, b 29, a 29.50; New York, a 85; New York and New Jersey, a 80; New York and Pennsylvania, b 50, a 80; New York State Overland, b 90, a 105; Overland, b 10, a 15; People's, b 10.50, a 12; People's (N. E.), b 1.50; Shaw, b 20; Solenoid, a 90; Southern Bell, b 95, a 125; Southern New England, a 175; Tropical, b 2, a 2.50; West India Telegraph and Telephone, b 2, a 2.25.

The Boston *Advertiser*, of May 1, thus quotes the local market: In telephone stocks, Erie declined ¾ to 29; Bell advanced ¼ to 163.

ELECTRIC LIGHT.—American, b 2, a 4; Baxter, b 22, a 23; Brush, b 50, a 80; Brush Illuminating, b 45, a 70; Daft, b 40, a 60; Edison Illuminating, b 55, a 75; Edison Isolated, b 55, a 90; Edison, European, b 3, a 15; Excelsior, a 35; Swan Incandescent, a 40; United States, b 90, a 95; United States Ill. Co., a 90.

BUSINESS NOTICES.

REMOVAL.—The Edson Speed Recording and Alarm Gauge Co., 77 Liberty street, New York City. Mr. M. B. Edson, president and manager, have removed from 77 Liberty St. to their new salesrooms 91 Liberty street. The Edson gauges have been placed on board the steamer "Bear" of the Greely Relief Expedition, and on the U. S. steamers "Shenandoah," and "Ossippee." The Lighthouse Department has also adopted them for its steam fog signals; the St. Johns, Newfoundland, Marine and Fisheries Department is using them for steam and fog signals; and Sir James N. Douglass, the Chief Engineer of the English Trinity House says: "We have twenty-nine Edson Time and Pressure Recording Gauges in use at our Fog Signal Stations, and they have given every satisfaction." Columbia College, and Girard College and Stevens Institute also have these instruments in use.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

Edited by N. S. KEITH, Electrical Engineer and Expert, 237 Broadway, New York.

PATENTS DATED APRIL 15, 1884.

Apparatus for Distributing Electrical Currents; George W. Durbrow, of Portland, Oregon... 297,072

Two discs, with conducting peripheries, are rotated in contact with two brushes, one for each disc. The discs through the brushes are the positive and negative terminals of the source of electricity. A spring from each disc is made to come sucessively in contact with fixed pins, representing a like number of terminals of other circuits. The electric current from the source is thus switched successively into the several circuits.

Dynamo-Electric Machine; Elihu Thomson, of New Britain, Conn., Assignor to Thomson-Houston Electric Co., of Connecticut..... 296,799

Consists in the combination, with the field-magnet of a dynamo-electric machine, of a secondary or storage battery in a bridge around the field-magnet coils, the current from which battery may discharge through said coils in the same direction as the current that normally charges the field-magnet, so as to preserve the polarity of the field-magnet.

Device for Connecting the Elements of Secondary Batteries; William Lachlan, of London, England, Assignor to the Light and Force Co., of New York..... 296,849

Screw studs are cast into the uppermost edge of the lead battery plates and holes are provided in the covers of the cells, through which holes the screw studs project to receive the connectors which are bound to place by nuts on the screw studs.

Dynamo-Electric Machine; Adolph E. Gustav Lubke, of New York, N. Y..... 296,857

The armature is of the "disc armature" type and is composed of radial bars, all in the same plane and connected up in two or more circuit rings by means of lateral connections that pass alternately from the outer and inner ends of the radial bars.

Electric Call-Bell; George P. Conant, of Geneva Lake, Wisconsin, Assignor by direct and mesne assignments, of one-half to Albert E. Lytle and Robert B. Smith, both of Chicago, Ill..... 296,729

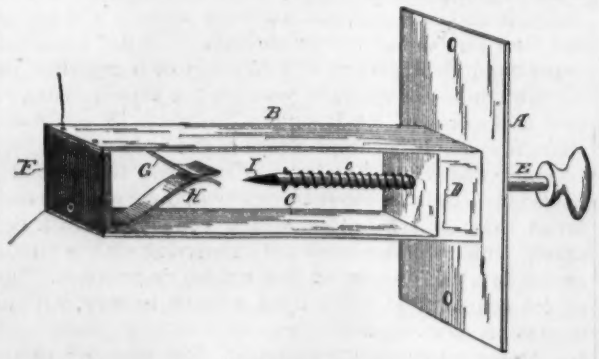
Consists in the combination, with a bell and its vibrating hammer, of a spring-actuated striking-wheel and a balance-lever escapement actuated by an electro-magnet whereby one or more positive calls or strikes may be given at the will of the operator.

Telegraphic Cable; William R. Patterson, of Chicago, Ill., assignor, by mesne assignments to the Western Electric Co. of same place..... 296,774

Consists of a core of electrical conductors covered by a sheathing consisting of a pipe composed of an alloy of tin and lead in proportions varying from ninety to ninety-seven parts of lead, to from three to ten parts tin.

Electric Door-Bell Pull; Selwyn Nivison Blake, of Elmira, N. Y..... 296,812

The two wires from the battery circuit including an alarm bell, are electrically connected with the springs *G* and *H*, the positive to one, the negative to the other. When the knob *E* is pulled



outward the insulating tip *I* is withdrawn from between the springs, and they come together, as shown in the Figure, to make the circuit in which is the alarm bell. When the knob is released the spiral spring *e* pushes the point *I* back between the springs to break the circuit.

Telephone; Webster Gillett, of Flushing, N. Y., Assignor to The Atlantic & Pacific Telephone Co., of Saco, Maine..... 296,829

Four or more electrodes are placed so as to impinge on the rim of a concave electrode fixed by its centre to the diaphragm of a transmitter. Each of the four electrodes has its separate primary circuit and a secondary coil for each circuit. But the secondary coils are connected in multiple arc to a single line and to ground.

Electric Fire Alarm Apparatus; Major Dane Porter, of Boston, Mass..... 296,874

Clock-work mechanism, which may be released by movement of an armature of an electro-magnet, is located in a building and on a circuit connected with the fire alarm station. Branch wires are run through the rooms of each story of the building. When a fire occurs the heat of it brings about a closure of circuit in any of the known ways. The armature is moved by the current thus allowed to flow, and the clock-work moves signal-sending wheels connected with the circuit leading to the station.

Electrical Alarm Apparatus; Major Dane Porter, of Boston, Mass., and Edmund Raynsford Wilder, of Portland, Me., Assignors, by mesne assignments, to said Porter..... 296,875

An arrangement of parts which insure a notice of a break in a fire-alarm circuit.

Electric Arc Lamp; Joseph J. Skinner, of Newtonville, Mass..... 297,022

Consists in the combination with the lamp of a clutch, the jaws of which are operated to grip or release the carbon-rod, without bodily movement of the clutch, by an electro-magnet attached to the clutch and movable therewith when the clutch is raised to form the arc, which is formed by another electro-magnet lifting the clutch in the usual way.

Insulator; John A. Seely, New York..... 296,881

Consists of an insulating-eyelet, which may be conveniently attached to the cross-arms of telegraph-poles or other supports, and which are adapted to carry a series or group of wires, whereby the individual wires of the group may be separated therefrom and run in divergent directions, and also in the method of distributing the wires of a cable.